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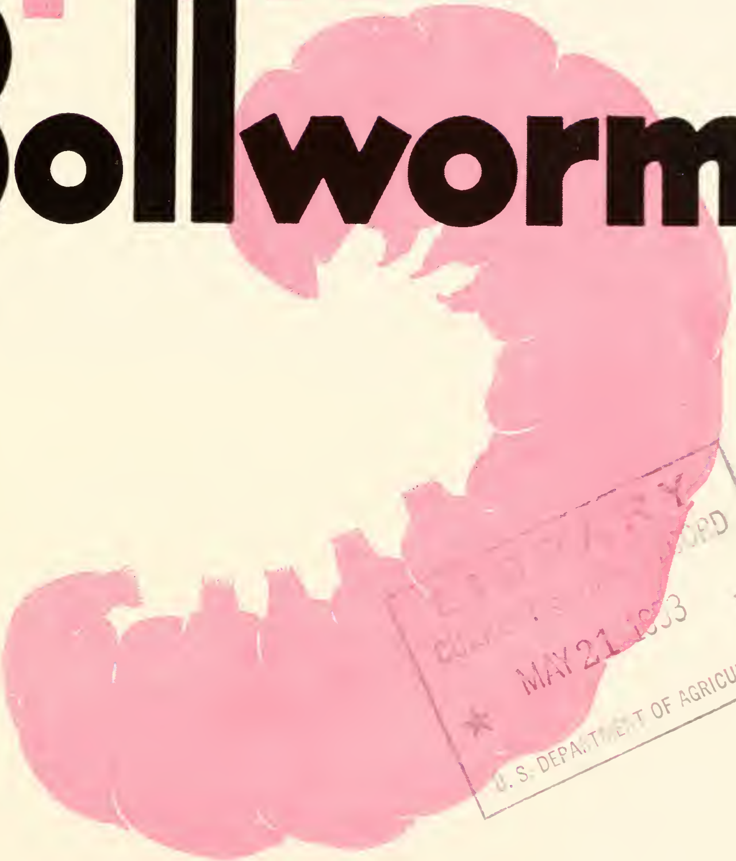
UNITED STATES DEPARTMENT OF AGRICULTURE • Leaflet No. 339

THE Pink Bollworm



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U. S. DEPARTMENT OF AGRICULTURE

HOW WE FIGHT IT

You Can Help IN LOCATING NEW INFESTATIONS of the pink bollworm. If you find pink bollworms in your cottonfield, and your farm is in a previously noninfested area, inform your county agent and other cotton growers in your area so that cooperative control measures can be undertaken. The illustrations on page 5, which are in natural color, will help you identify the pink bollworm.

If you find worms and are not sure whether they are pink bollworms, put a few in a bottle of diluted alcohol, and send bottle and contents to the Bureau of Entomology and Plant Quarantine, Washington 25, D. C., or to the Director, Region 3, Bureau of Entomology and Plant Quarantine, P. O. Box 2300, San Antonio, Tex. Enclose full information as to date and place of the collection, and give your name and address. Do not send live insects through the mail. It is against the law to do so.

THIS LEAFLET was prepared by the Division of Insects Affecting Cotton and Other Fiber Plants (Washington, D. C.) and the Pink Bollworm Control Project (headquarters in San Antonio, Tex.), Bureau of Entomology and Plant Quarantine, Agricultural Research Administration, United States Department of Agriculture.

Washington, D. C. **Issued May 1953**

THE PINK BOLLWORM • *How We Fight It*

In many parts of the world the pink bollworm[1] is more destructive than any other cotton insect.

In India, China, Egypt, and Brazil it has been destructive for many years. Estimates by officials of those countries show that annual losses amount to hundreds of millions of dollars. In Brazil alone, where the cotton acreage is about one-fifth that of the United States, annual losses are estimated at more than $50 million.

The pink bollworm has been in the United States since 1917, when it was found at Hearne, Tex. Infestations exist in parts of several States, but commercial damage has been confined to southern Texas and to small areas in western Texas.

HOW IT DAMAGES COTTON

Pink bollworm damage to cotton is done by the larvae, or caterpillars, which eat out the seeds in the green bolls. The adults, which are moths, do not harm cotton plants.

Within a boll, a larva goes from one seed to another, eating out the kernel of each. Seeds from infested bolls are light in weight and low in viability. Also, the content and value of the oil are greatly reduced.

The pink bollworm gets to the seeds by cutting paths or mines through the immature lint, thus adding lint damage to seed damage. In going from seed to seed, it cuts and stains fibers. Lint from infested bolls is short, discolored, and low-grade.

In heavily infested fields many of the bolls are so badly damaged that they are not picked. The cotton in them is worthless.

ORIGIN AND SPREAD

The original home of the pink bollworm was in southern Asia, probably India. During this century it has spread rapidly. It is found now in most countries in which cotton is grown. It spread from India to Egypt in cottonseed shipments. In the same way it spread from Egypt to Brazil and thence to Mexico.

When it was found in Texas, a quarantine was immediately placed on importation of cotton, but the worms were already doing serious damage in Mexico, and the Rio Grande is no barrier to the pink bollworm adults. The moths are carried long distances by wind.

The pink bollworm occurs on commercial cotton in most parts of Texas and in certain parts of Arizona, New Mexico, Oklahoma, and Louisiana. It also occurs on wild cotton in Florida. Damage and spread are held down by Federal and State quarantines, which regulate the shipment of cotton and its products from infested areas, and by control measures carried out jointly by government agencies, cotton growers, and cotton processors.

HEAVY LOSSES IN TEXAS

In recent years weather conditions have lessened the effectiveness of pink bollworm control measures in parts of our cotton region. The insect has spread and built up rapidly, especially in Texas.

Unfavorable weather prevented many Texas farmers from following the good cultural practice of destroying cotton stalks immediately after harvest. It also disrupted planting and harvesting schedules. Some farmers planted early, in accordance with another good cultural practice, and some planted late. When early-planted cotton matured, it furnished a reservoir of pink bollworms to infest late-planted cotton in adjoining fields, and large numbers of pink bollworms overwintered in the late-maturing bolls.

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[1] *Pectinophora gossypiella.*

In one year the pink bollworm caused losses in a 38-county area in southern Texas that were estimated at more than $28 million.

APPEARANCE AND STAGES OF DEVELOPMENT

The pink bollworm has four stages of development: Egg, larva (or caterpillar), pupa, and adult.

The adults are small, grayish-brown moths. They look much like clothes moths.

Early in the cotton season female moths lay eggs on cotton stems, squares, and terminal buds. When green bolls are fully grown, the moths usually lay most of their eggs in masses beneath the glovelike calyx at the base of the bolls. A moth lays 100 to 200 eggs, which are white and oval.

The eggs hatch in about 5 days. The newly hatched larvae, which are glossy white and have light-brown heads, eat their way into squares or bolls, where they feed 10 to 14 days. At the end of this period they are full-grown larvae. They are about 1/2 inch long, and are light cream-colored to pinkish.

Many of the larvae feeding in squares drop to the ground and pupate in cracks in the soil or in surface trash.

Larvae in bolls feed on the seeds. When a larva is through feeding in a green boll, it either cuts a small hole through the carpel wall and drops to the ground to pupate, or remains in the seed in which it developed.

A larva remaining in a boll may hibernate in a single seed, or it may pull two hollowed-out seeds together and unite them by spinning a continuous cocoon within the two cavities. Seeds thus united are called double seeds, and their presence after ginning is an indication that the pink bollworm is there.

The pupae transform to moths, and in 3 or 4 days the female moths start laying eggs. The adults are active only at night. In the daytime they stay under trash or clods of dirt, or in cracks in the soil.

In midsummer the pink bollworm completes its life cycle in 25 to 30 days. There may be as many as six generations in a year.

CONTROL MEASURES

Cultural Practices

Good cultural practices go a long way in controlling the pink bollworm and other insects. Some practices are effective only if all growers in an area follow them.

Get your neighbors to cooperate.

DESTROYING STALKS

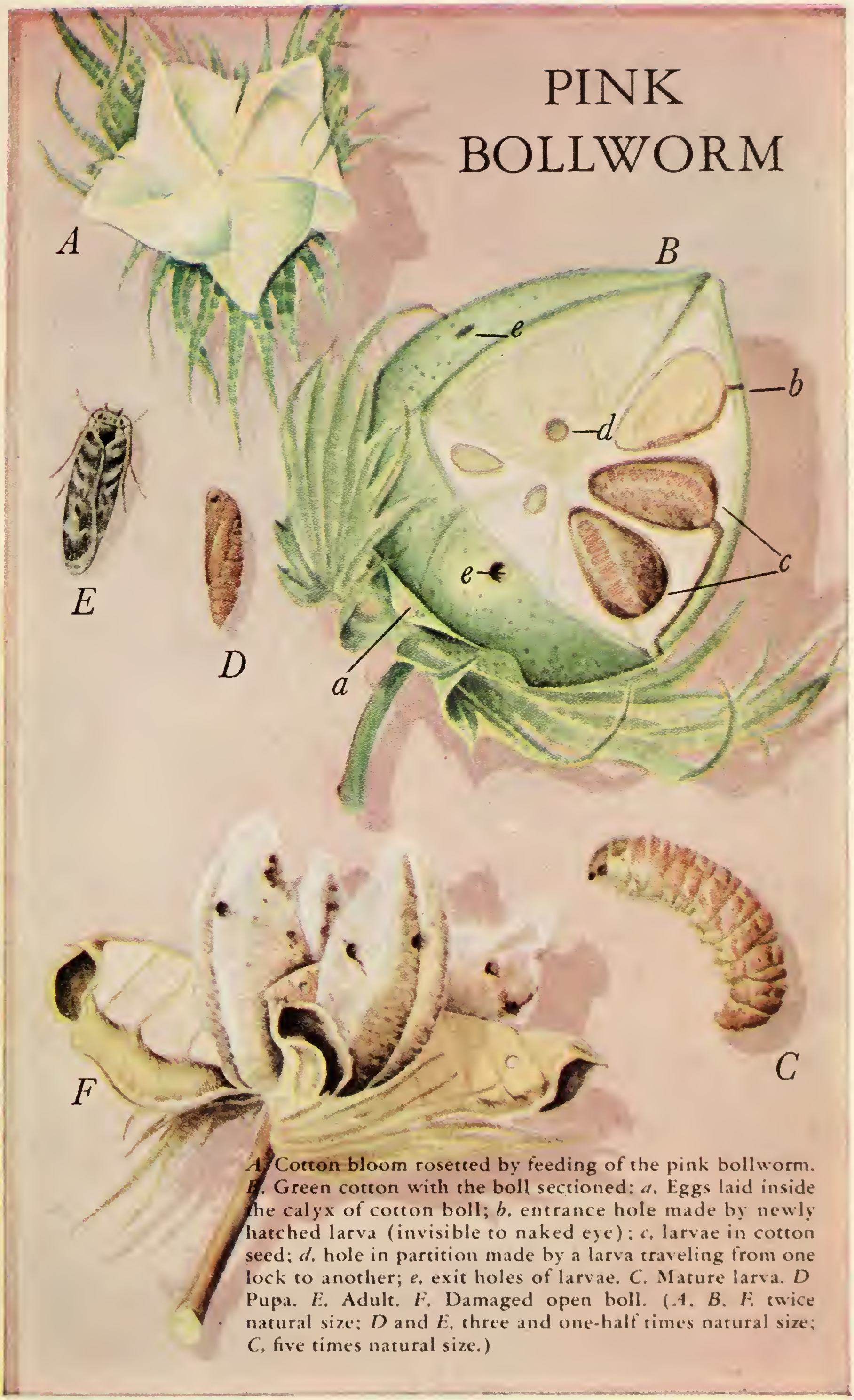
If you live in an area where cotton can be harvested before frost, pick your cotton as early as possible and destroy the stalks as soon as harvesting is completed. The purpose of early stalk destruction is to reduce the number of pink bollworms that overwinter in crop residue. Pink bollworms are carried over from one crop year to the next in the bolls and locks of unpicked cotton.

Destroy stalks with one of the new-type shredders. Besides killing many insects during the shredding, these machines spread the residue on the ground so evenly that the sun usually kills many more.

Leave the residue on the soil surface at least 3 days. Then immediately plow it under to a depth of 5 or 6 inches. The deeper you plow it under, the more you will decrease the number of pink bollworms that will survive.

When crop residue containing pink bollworms is plowed under, the chances for their survival are increased if the ground lacks sufficient moisture to cause decay of the residue before spring. Therefore, if you live in an arid area, such as western Texas, where harvesting must be completed after frost, the amount of winter rainfall determines whether stalks should be plowed under.

PINK BOLLWORM



A. Cotton bloom rosetted by feeding of the pink bollworm. *B*. Green cotton with the boll sectioned: *a*. Eggs laid inside the calyx of cotton boll; *b*, entrance hole made by newly hatched larva (invisible to naked eye); *c*, larvae in cotton seed; *d*, hole in partition made by a larva traveling from one lock to another; *e*, exit holes of larvae. *C*. Mature larva. *D* Pupa. *E*. Adult. *F*. Damaged open boll. (*A*. *B*. *F*. twice natural size; *D* and *E*, three and one-half times natural size; *C*, five times natural size.)

Soon after harvesting is completed, destroy cotton stalks with a shredder. In this way you reduce the number of pink bollworms that overwinter in crop residue.

Where the winter rainfall is sufficient to keep the ground moist, destroy the stalks with a shredder and plow them under as soon as harvesting is completed. Do not leave them on the ground 3 days, as you would in an area where harvesting can be completed before frost. After frost there is little likelihood that the sun will kill pink bollworms left on the ground.

Where there is little winter rainfall, leave the stalks standing, but remove as many bolls as possible. Heavy pasturing with cattle, sheep, or goats is helpful. If you plow under the stalks in early winter, and the field can be irrigated, it is advisable to irrigate it immediately.

Okra is the only other widespread, commercially grown crop that the pink bollworm attacks. The same care should be given to destroying the residue of this crop that is given to destroying cotton residue.

Other practices

Other cultural practices that will aid in the control of the pink bollworm and other insects include: Planting noninfested, certified seed of a variety recommended for your locality; early planting; using fertilizer recommended for your locality; practicing clean cultivation; using chemical defoliants to speed up harvest; and harvesting as early as possible.

Insecticides

Do you need to use them?

When cultural methods fail to keep the pink bollworm from being destructive, insecticide applications are necessary.

Shortly after the cotton starts blooming, make counts to see whether the pink bollworm infestation is heavy enough to justify insecticide treatment. Look for rosetted blooms. These have petals fastened together at the tips by the worms' webbing. In the early part of the growing season such blooms furnish the best evidence of an infestation. After the cotton produces full-grown bolls, pink bollworms tend to attack the bolls rather than squares, and very few rosetted blooms are likely to be found.

Take 100 steps down a row and collect all the infested blooms that you find. Do this at 5 representative points in the field. Multiply by 10 the number of infested blooms found in the 500 steps. The number thus obtained is the approximate number of worms in each acre. If you find 100 or more infested blooms or bolls to the acre, the infestation is heavy enough to justify immediate insecticide treatment.

Insecticide treatment

When inspection shows that use of

an insecticide is warranted, apply DDT or a mixture of DDT and EPN.

DDT should be applied either as a dust or as a spray at the rate of 2 to 3 pounds of technical DDT to the acre at weekly intervals.

The mixture of DDT and EPN should be applied at the rate of 1.5 pounds of technical DDT and 0.5 pound of EPN to the acre at weekly intervals.

Repeat the application until most of the bolls are open.

If insects other than the pink bollworm require control, mix DDT with other insecticides. If control of other insects makes it necessary to reduce the interval between applications to 4 or 5 days, and DDT is used in combination with other insecticides, reduce the rate of application of the DDT to 1.5 to 2 pounds to the acre.

To be effective against pink bollworms, the insecticide must thoroughly cover the cotton plants.

If aphids should develop when DDT is used alone or in combination with EPN, add TEPP or parathion to the spray, or parathion to the dust. Add the TEPP or parathion in an amount that will give the rate of application that is recommended for control of aphids in your locality.

To control spider mites at the same time that you control pink bollworms, (1) use a DDT-sulfur dust that contains at least 40 percent of sulfur, or (2) apply sulfur alone at the rate recommended for control of spider mites in your locality, or (3) add parathion or Aramite to the DDT dust or spray in an amount that will give the rate of application that is recommended for control of spider mites in your locality.

Apply these insecticides with properly equipped sprayers or dusters. Attach cone-type nozzles to the hoses. Use two or three nozzles for each row of cotton. Operate the sprayer at a pressure of 40 to 60 pounds per square inch.

PRECAUTIONS

In handling insecticides, follow strictly the precautions given on the labels.

Use special care in handling TEPP, parathion, and EPN. Avoid breathing vapors and dusts from these insecticides. Wear a tight-fitting gas mask, or respirator, equipped with a canister. Follow the directions given by the manufacturer of the mask regarding replacement of the canister after it has been used. Do not smoke while working with these insecticides.

Do not let insecticides get on the skin or in the eyes.

Do not use insecticides when the wind is strong. Do not mount spraying equipment on the front of tractors.

Keep shirt sleeves down and shirt collar buttoned.

Bathe and change clothes as soon as the spraying or dusting job is finished.

Cotton-insect insecticides will kill honey bees. Before applying them, notify beekeepers within a mile of the cotton field.

Sprays applied by airplane from a height of 6 to 10 feet are effective. Spray when the wind does not exceed 10 miles an hour. Keep swaths no wider than the wing span of the plane, and use flagmen to mark the swaths.

If rain washes dust or spray from the plants within 24 hours after application, repeat the treatment within 48 hours.

Treatment of Cottonseed

Cottonseed produced in a heavily infested area contains large numbers of pink bollworms. To destroy these worms, gins make heat-treating of the seed a part of the ginning process. The treatment is required by Federal and State regulations. Before the seed is moved into a noninfested area, fumigation with methyl bromide or a second heat treatment is required.

Other procedures required in heavily infested areas are the burning or heat-treating of gin waste, and the compressing of lint before it is moved into a noninfested area.

In lightly infested areas seed must be heat-treated or fumigated when it is received at oil mills or other treating plants.

Government inspectors supervise the sterilization and fumigation of cottonseed.

Quarantines

Federal and companion State quarantines control movement of cotton and its products, and okra, from all counties in which pink bollworm infestations are found.

Since 1913 a Federal quarantine has excluded from this country cottonseed and cottonseed hulls from most of Mexico and from all other countries. Sterilized seed and hulls produced in limited areas of Mexico may be moved into infested areas of the United States.

Cotton and its products (other than seed and hulls) enter the United States under highly restricted conditions. Imported cottonseed cake and meal containing uncrushed cottonseed must be fumigated at the port of entry.

Other Restrictions

States may set deadlines before which cotton must be planted and stalks destroyed. Such restrictions are now in force in Texas.

To clean up new or isolated infestations, States may establish zones in which cotton is not to be grown for 1 to 3 years. In these zones pink bollworms starve. Taking all cotton out of large districts is a stern measure, but it has eradicated the pink bollworm in several areas.

LOCATING INFESTATIONS

Each year Government inspectors make surveys in the cotton-producing States to determine the areas in which infestations exist.

Examination of gin trash is the chief means by which pink bollworms are detected in areas previously free of them. Many of the worms are carried to gins in seed cotton. At the gin the cleaning process separates some of them and discards them with the trash.

Ways in which the cotton grower can help in locating new infestations are explained on page 2.

WHERE WE STAND

The pink bollworm has been eradicated from Georgia, northern Florida, northern Louisiana, several locations in Texas, and the Salt River Valley of Arizona.

Constant vigilance is necessary to prevent its spread. Infestations in southern Louisiana have been eradicated twice, but in 1952 pink bollworms again were present in some parishes there.

As long as the pink bollworm persists in the cotton-growing areas of the United States, Mexico, and other parts of the world, we cannot relax our fight against it.

The Mexican Government is cooperating fully with the United States in an effort to suppress infestations and prevent spread. Cotton farmers in Mexico and in the United States use the same control methods.

In cooperation with other Federal agencies, with State agencies in the cotton-producing region, and with cotton growers and processors, the Bureau of Entomology and Plant Quarantine is intensifying its study of the pink bollworm and is broadening its search for more effective control measures.

ADDITIONAL INFORMATION

Some of the methods recommended for controlling the pink bollworm vary according to locality. You may need additional information about destruction of crop residue, controlling cotton insects other than the pink bollworm, and similar matters. If so, consult your county agent, or an agronomist or entomologist in your State extension service or experiment station, *or* write to the United States Department of Agriculture, Washington 25, D. C.

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